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IMAGE ANALYSIS STUDY OF SAMPLES FROM THE SOUTH BAY AND DETOUR DEPOSITS OF SELCO MINING CORPORATION

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IMAGE ANALYSIS STUDY OF SAMPLES FROM THE SOUTH BAY AND DETOUR DEPOSITS OF SELCO MINING CORPORATION

by

M.R. Hughson* and W. Petruk**

INTRODUCTION

Four samples of mill products were received on March 30, 1978 from Mr. G.W. McDonald of Selco Mining Corporation Limited, Suite 700, 55 University Avenue, Toronto, Ontario, M5J 2H7, for an image analysis study as a cost recovery Project No. 4.3.3.9.03, Contract No. 024167. Two samples were from the South Bay deposit and two from the Detour property. Mr. MacDonald requested that mineral liberations and size distributions for the zinc and copper sulphides be determined in order to account for the zinc loss in the South Bay samples and to ascertain the optimum grind for liberation of sphalerite in the Detour samples.

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SAMPLES

The samples received are listed in Table 1.

TABLE 1

Samples from Selco Mining Corporation

Sample	Cu Wt %	Zn Wt %	Fe Wt %	Pb Wt %	Ag g/T	Acid Insol.
1. South Bay, Zn Conc.	-	-	-	-	-	-
2. South Bay, final Zn Tails	-	-	-	-	-	-
3. Detour 363 Cu Ro. Conc.	22.2	5.4	19.7	0.18	175	20
4. Detour 363 Tails	0.12	0.02	-	0.01	2.1	-

METHOD OF INVESTIGATION

One polished section was prepared from each sample, and the polished sections were analysed with the Quantimet 720 image analyser. The following properties were determined for Samples 1, 2, and 3.

(1) relative proportion of some metallic minerals;

(2) percentage of free sphalerite;

(3) size distributions of free sphalerite; and

(4) size distributions of locked sphalerite.

In addition, Samples 1 and 2 were analysed to determine the percentage of free chalcopyrite and the size distributions for total chalcopyrite. Sample 3 was also analysed to determine size distribution of all metallic minerals (free plus combined).

RESULTS

South Bay Samples

The relative proportions of sphalerite to pyrite plus chalcopyrite, based on 100 Wt % for these three minerals, is 90.2:9.8 for the zinc concentrate and 8.6:91.4 for the final zinc tails.

The percentages of sphalerite and chalcopyrite occurring as free grains are given in Table 2. The values for free sphalerite are based on the analysis of about 10,000 to 15,000 sphalerite grains and those for free chalcopyrite on the analysis of all the chalcopyrite grains in the polished sections (45 in the zinc concentrate and 5 in the final zinc tails). The value for free sphalerite in the zinc concentrate is the same as in a zinc concentrate submitted to W. Petruk from the same mill in April 1976. The value for free sphalerite in the final zinc tail, however, is significantly higher than in the April 1976 sample (49%).

TABLE 2

Percent Free Grains

Sample	Sphalerite	Chalcopyrite
Zn Conc.	91.5	33
Final Zn Tails	68	20

The size distributions for free and locked sphalerite and total chalcopyrite are given in Table 3.

TABLE 3

Size Distribution for Minerals in South Bay Sample
(Cumulative % Passing)

Size Range µm	Zinc Concentrate			Final Zinc Tails		
	Free sphal.	Locked sphal.	Total chalco.	Free sphal.	Locked sphal.	Total chalco.
- 6.5	11	2	1	1	27	6
6.5 - 9.5	25	7	2	2	32	12
9.5 - 13	35	15	4	4	38	17
13 - 18.5	50	30	9	7	45	35
18.5 - 26	64	46	15	15	58	65
26 - 37	80	62	42	28	80	100
37 - 54	94	80	87	80	100	
54 - 74	99	93	100	100		
+ 74	100	100				

The results indicate that the reason for loss of Zn in the South Bay samples is that large (>18.5µm) free sphalerite grains are lost in the final zinc tails.

Detour Sample (Cu Ro. Conc.)

The relative proportions of pyrite, sphalerite, chalcopyrite, chalcocite and covellite were determined and these values were used to calculate the mineral quantities in the sample (Table 4) as follows:

(1) The proportion of bornite was estimated, the proportions of copper held by each mineral were determined from the analysed relative proportions of the copper-bearing minerals and their stoichiometric compositions.

(2) The sum of copper determined in Step 1 was divided by the chemically analysed quantity for copper in the sample (22.2 wt %) to establish a factor.

(3) The relative proportion of each mineral was multiplied by the factor from Step 2 to obtain mineral quantities.

(4) The difference between total quantities for metallic minerals and 100% was taken as quantity of gangue.

The sphalerite content determined by this method (8.0%), corresponds exactly to the analysed value for zinc (5.4%). In addition, it was calculated from these values that about 2.5% iron is in mafic silicate minerals.

TABLE 4

Analysed Proportions and re-calculated quantities of Minerals in Detour 363 Cu Ro. Conc.

Mineral	Anal. Proportion	Recalc. Quantity
pyrite	15	10.0
sphalerite	10	8.0
chalcopyrite	59	39.3
chalcocite	8	5.3
covellite	6	4.0
bornite	4 (est.)	2.7
galena	trace	0.2
gangue	not analysed	30.5
	102	100.0

It was determined by image analysis that 20% of the sphalerite in the sample is free.

Size distributions for free sphalerite, locked sphalerite and total metallic minerals (free and composite metallic mineral grains) are given in Table 5. The results show that

there is significant change for locked sphalerite in the 26 to 37 micron size range. Hence the optimum grind for liberating sphalerite from this ore would be about 80% minus 26 microns.

TABLE 5

Size Distribution for grains in Detour 363
Cu Ro. Conc. (Cumulative % Passing)

Size Range µm	free sphal.	locked sphal.	Comp. Metallic Minerals
6.5	42	6	8
6.5 - 9.5	47	10	13
9.5 - 13.0	52	13	17
13 - 18.5	56	17	25
18.5 - 26	71	21	40
26 - 27	87	31	55
32 - 54	100	55	70
54 - 74		75	84
+ 74		100	100